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The Indiana University Pervasive Technology Institute: A year of accomplishment

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About the Indiana University Pervasive Technology Institute (@IU_PTI on twitter)

- The Indiana University Pervasive Technology Institute (IUPTI) transforms new innovations in cyberinfrastructure and computer science into robust tools and supports the use of such tools in academic and private sector research and development. IUPTI does this while bolstering the Indiana Economy and building Indiana's 21st century workforce
- IU_PTI is Indiana University's initiative for advanced information technology research, development, and delivery in support of scientific discovery, scholarly investigation, and artistic creation.
- Information technology today pervades scholarly discovery in the humanities, research in all areas of the sciences, and the processes of artistic creation. The "Pervasive" in the name IU Pervasive Technology Institute reflects the foundational importance of computer science, informatics, cyberinfrastructure, and information technology research to most of what is done in academia and industry today.
- The Indiana University Pervasive Technology Institute was created in 1999 by a major gift from the Lilly Endowment and persists today through a combination of competitively obtained federal funding, donations, and IU support

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IU_PTI Is a collaborative organization with seven affiliated centers:

- Center for Applied Cybersecurity Research, led by Von Welch. https://cacr.iu.edu/
- Center for Science Gateways and Distributed Cyberinfrastructure Research, led by Dr. Marlon Pierce. https://sgrc.iu.edu/
- Data to Insight Center, led by interim director Dr. Inna Kouper. https://pti.iu.edu/centers/d2i/index.html
- Digital Science Center, led by Distinguished Professor Geoffrey C. Fox. https://www.dsc.soic.indiana.edu
- Hathi Trust Research Center, led by Professor John Walsh. No active website yet.
- National Center for Genome Analysis Support, led by Dr. Thomas G. Doak. https://ncgas.org
- Research Technologies, led by Associate Vice President Matthew R. Link. https://pti.iu.edu/centers/rt/

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Stakeholders

- Office of the Vice President for Information Technology
- University Information Technology Services
- School of Informatics, Computing, and Engineering
- College of Arts and Sciences
- Maurer School of Law
- Kelley School of Business

PTI Is constituted flexibly to bring together the intellectual and organizational assets of IU to important problems facing society today, while making the organizational structure of IU irrelevant to the collaborations in which it is engaged

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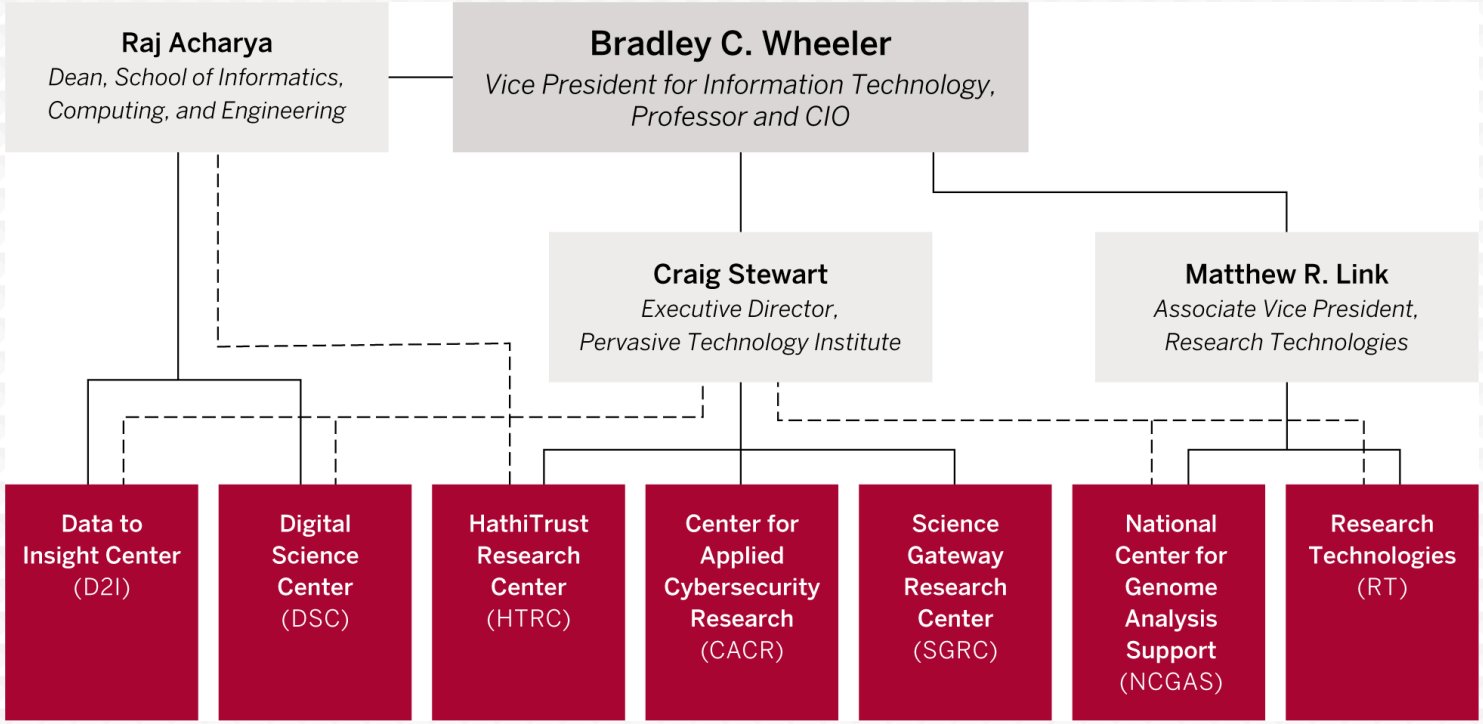
PTI organizational chart



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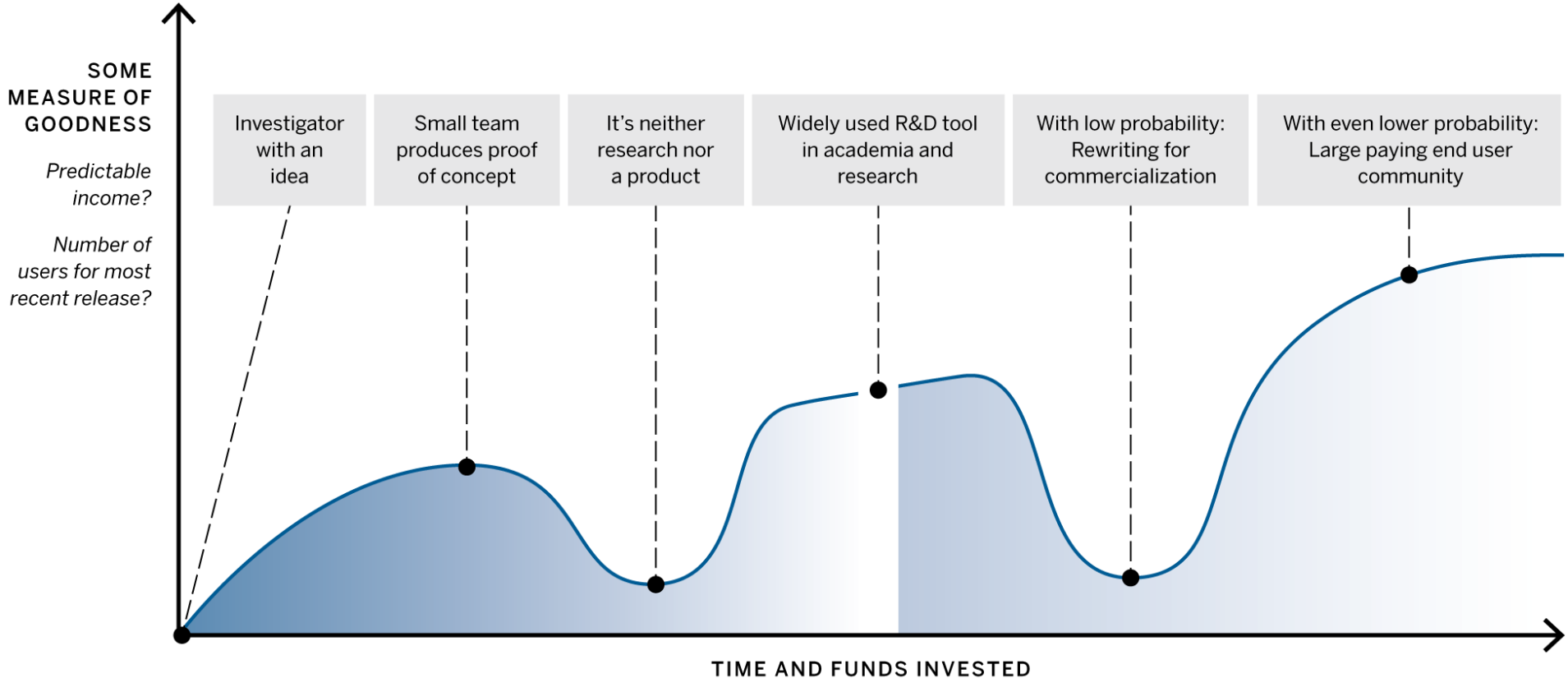
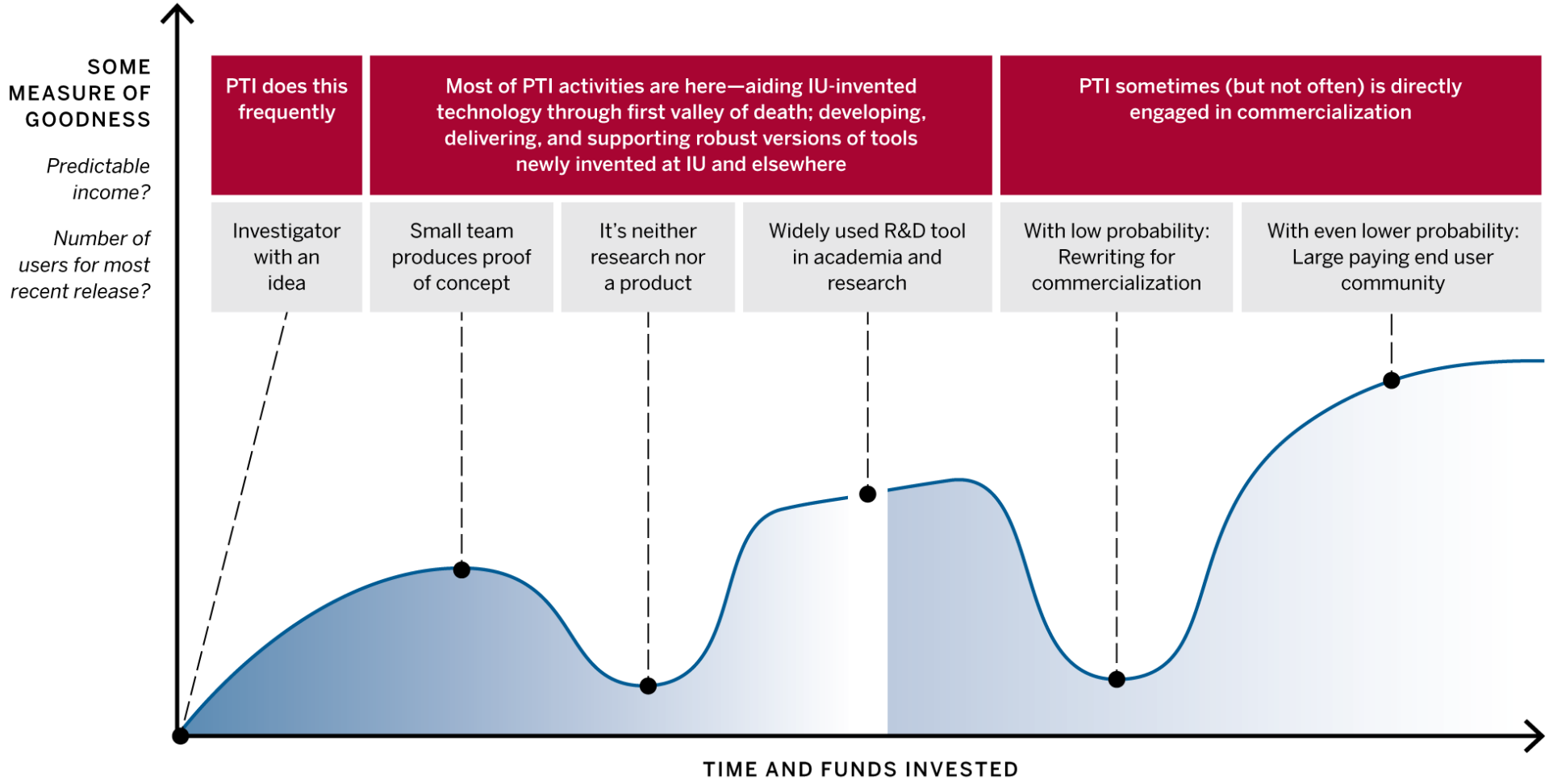
The *two* valleys of death



PTI takes services and tools through the two valleys of death



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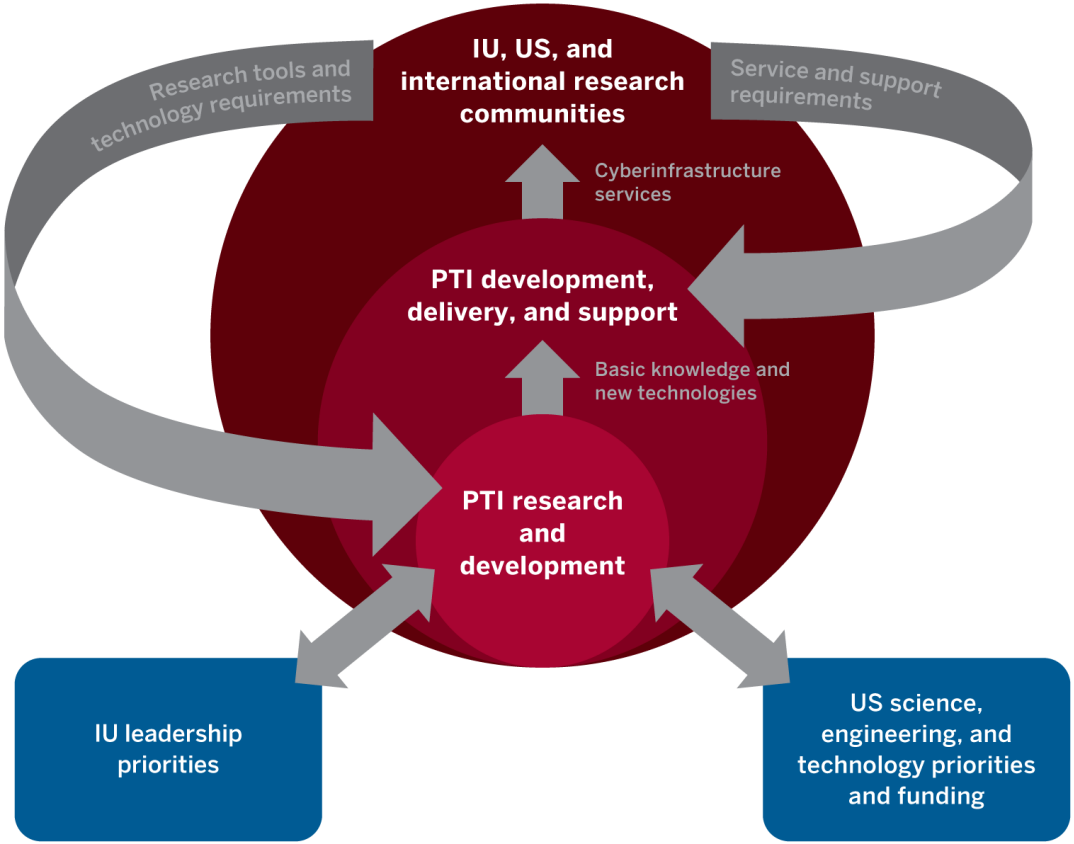
What drives PTI, and what PTI drives



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PTI successes in 2018

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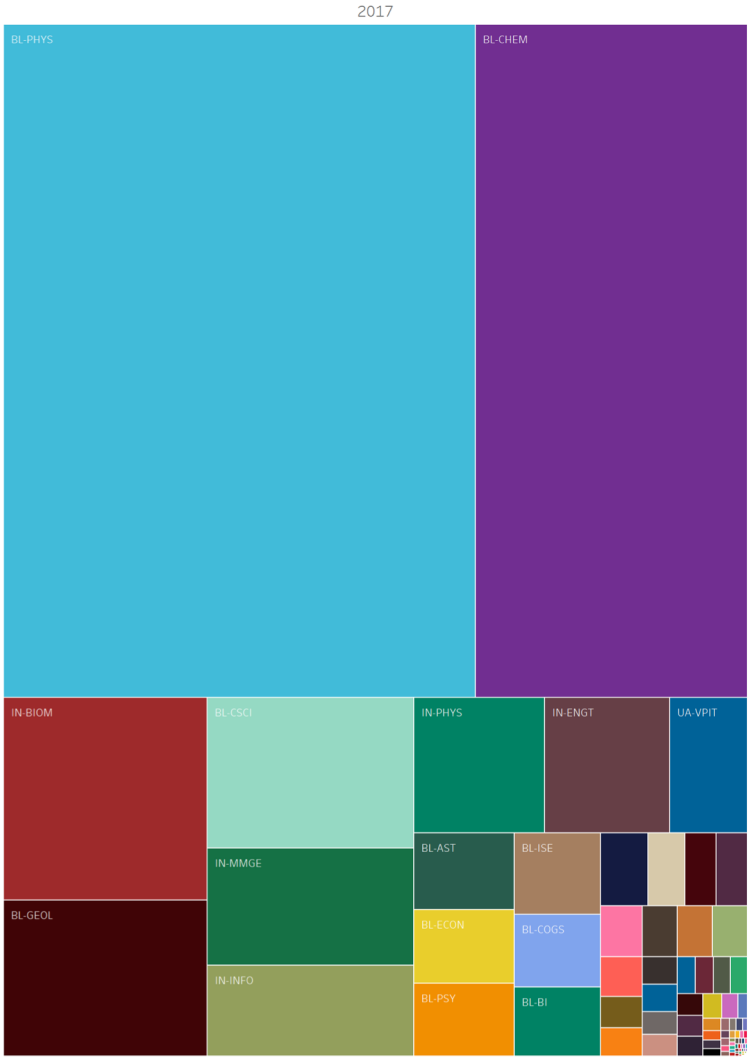
Breadth of impact on IU research, scholarship, and creative communities

134 different departments use IU's advanced research cyberinfrastructure provided and supported by the Research Technologies Division of UITS

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Jetstream

SCIENCE GATEWAYS RESEARCH CENTER

INDIANA UNIVERSITY

Pervasive Technology Institute

Marlon Pierce
Indiana University
https://sgrc.iu.edu

What Are Science Gateways?

Web interfaces and middleware for integrating distributed computing and data, automating expertise, controlling access, managing results, and speeding up your critical computational workflows

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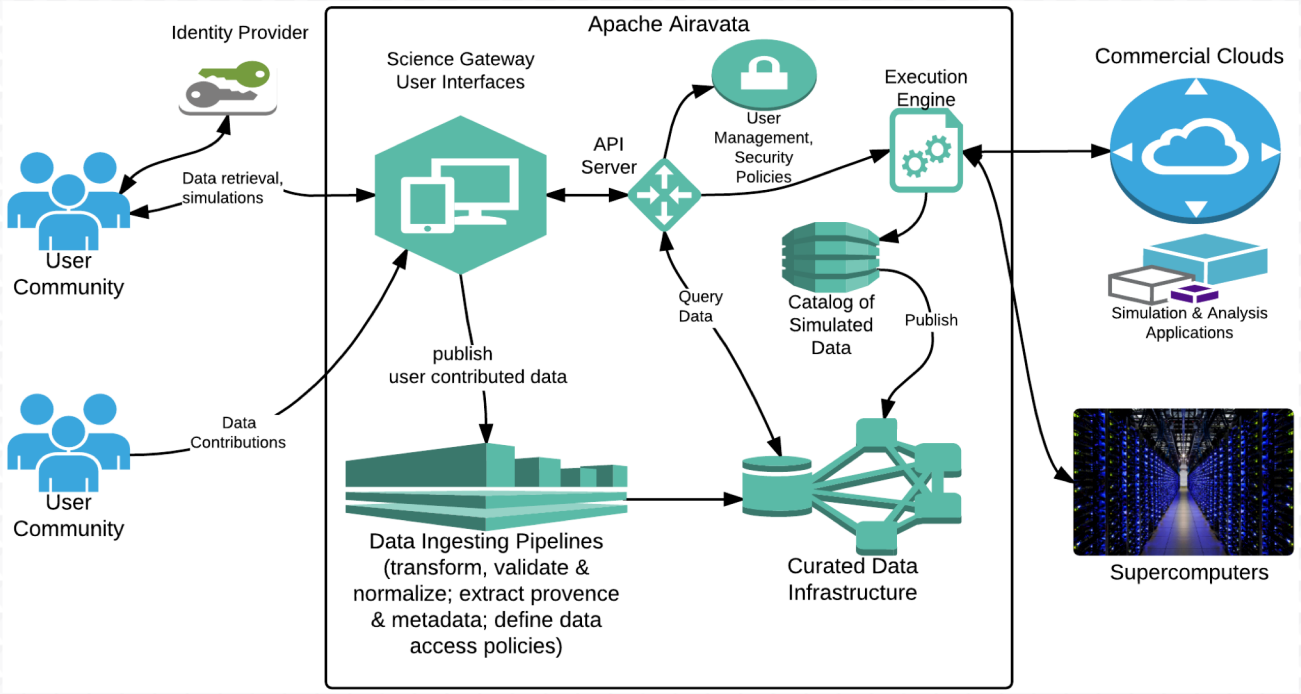
Apache Airavata: Science Gateway Middleware



Domain and Application Gateways

Title	Field of Science
SEAGrid Gateway	Chemistry & Engineering
Ultrascan Gateway	Biophysics
CIPRES Gateway	Systematic & Population Biology
NSG Gateway	Neuroscience Biology
PGA	Computer & Information Science & Engineering
dREG Gateway	Genetics & Nucleic Acids
Phasta Gateway	Mechanical Engineering
SimCCS Gateway	Geology Survey
Computational Systems Biology Group(CSBG) Gateway	Biological Science
SimVascular Gateway	Cardiovascular Simulation
IU Nano Confinement Gateway	Materials Research
Searching-SRA Gateway	Bio-informatics and Biology
Longitudinal GWAS gateway	Biostatistics
InterACTWEL Science Gateway	Natural Resources Management Decisions Support
NextGen Thermodynamics Database Gateway	Geochemistry & Environmental Science

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HATHI TRUST RESEARCH CENTER

HathiTrust Research Center

computational research with the HathiTrust collections

John A. Walsh, Director, HathiTrust Research Center
(with thanks to Mike Furlough, Executive Director, HathiTrust)

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HathiTrust Research Center

- Developed collaboratively by Indiana University and University of Illinois and with funding from HathiTrust.
  - Grants from Mellon Foundation, Nat'l Endowment for Humanities, Institute of Museum and Library Services, Sloan Foundation.
- Persistent and sustainable structure to enable original and cutting edge non-consumptive researchHathiTrust contributes to research, scholarship, and the common good by collaboratively collecting, organizing, preserving, communicating, and sharing the record of human knowledge.
- Over the next five years HathiTrust will be a vital catalyst for emerging forms of research, teaching, and learning that engage the scholarly and cultural record.

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Non-consumptive research?

Non-consumptive

Computational techniques such as:

statistical analysis & data extraction

linguistic analysis

automated translation

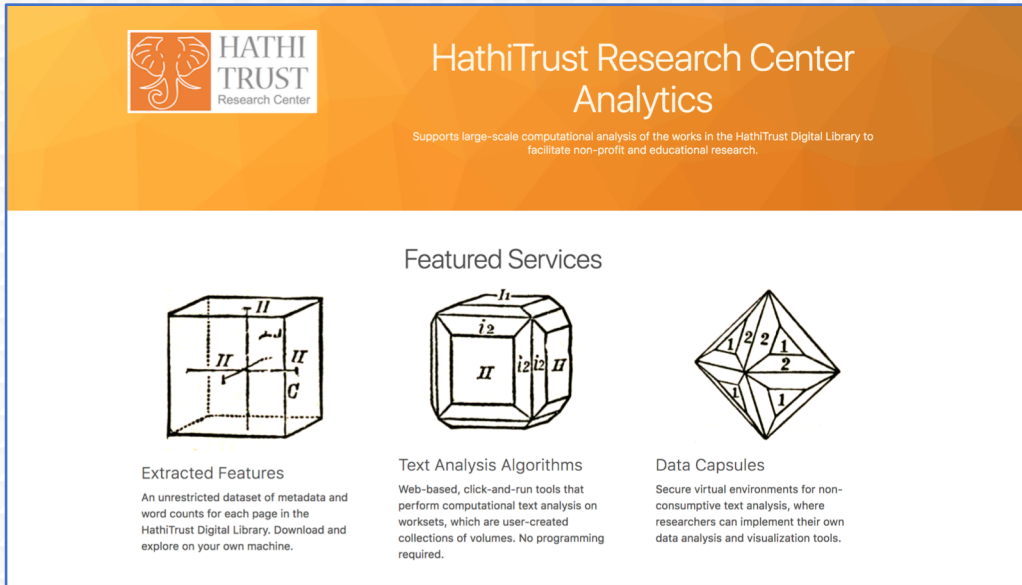
image analysis

OCR correction

indexing and search

Consumptive – "consuming" the content

Reading or display of substantial portions of an in-copyright or rights-restricted volume to *understand the expressive content presented within that volume*.



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Women Were Better Represented in Victorian Novels Than Modern Ones

Big data shows that women used to be omnipresent in fiction. Then men got in the way

A decline in women authors and named characters has subtly shaped our understanding of literary history, says study author Ted Underwood. (Wikimedia Commons)

By Kat Eschner
SMITHSONIAN.COM
FEBRUARY 14, 2018

- U of Illinois English Prof. Ted Underwood, UC-Berkeley Info Science Prof. David Bamman, and Sabrina Lee, U of Illinois
- Algorithm analyzed the characters and authors of 104,000 novels (1703 to 2009) in HathiTrust.
- Findings: a paradox. As rigid gender roles seemed to dissipate moving into the 20th C. , indicating more equality between the sexes, the number of women characters— and proportion of women authors— decreased.
- Published in the journal *Cultural Analytics*

Source: https://www.smithsonianmag.com/arts-culture/what-big-data-can-tell-us-about-women-and-novels-18096815

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CENTER FOR APPLIED CYBERSECURITY RESEARCH
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The CACR Approach to Modern Cybersecurity

Von Welch, Director

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Cybersecurity at Indiana University: Transitional and Interdisciplinary

Cybersecurity Operations and Applied Research with National Impact.

World-leading Cybersecurity Education.

OmniSOC

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SICE

KELLEY SCHOOL OF BUSINESS

TRUSTED CI
THE NSF CYBERSECURITY CENTER OF EXCELLENCE

ResearchSOC

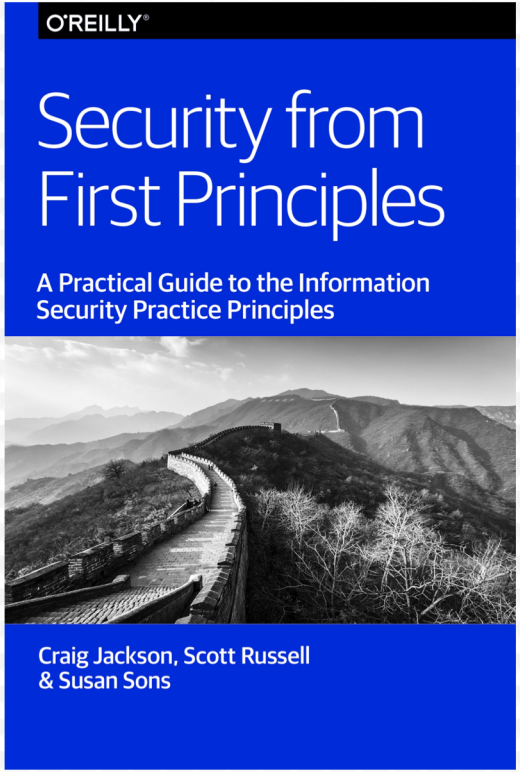
Maurer School of Law

REN-ISAC

PROTECT IU
Protect.IU.edu

Principle-Based Cybersecurity

- Comprehensivity
- Opportunity
- Rigor
- Minimization
- Compartmentation
- Fault Tolerance
- Proportionality



https://cacr.iu.edu/principles/

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CACR Leads Two Key NSF Cybersecurity Centers

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TRUSTED CI
THE NSF CYBERSECURITY CENTER OF EXCELLENCE

The mission of the NSF Cybersecurity Center of Excellence, lead by CACR, is to provide the NSF community a coherent understanding of cybersecurity's role in producing trustworthy science and the information and know-how required to achieve and maintain effective cybersecurity programs.

In 6th year with over $12m total funding from NSF.

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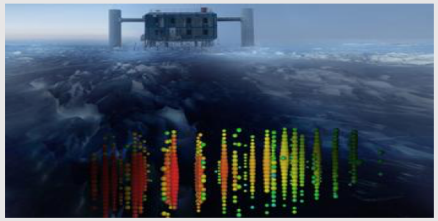
ResearchSOC

OmniSOC



STINGAR

3ROX
THREE RIVERS OPTICAL EXCHANGE

Existing Higher Ed Information Security Professionals

PITTSBURGH SUPERCOMPUTING CENTER

UC San Diego

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HIPAA Compliance and Third Party Risk Assessment

- CACR oversees HIPAA compliance for IU central research and enterprise systems (UITS).
  - Leverages the NIST Risk Management Framework (RMF) and NIST 800-53 controls for comprehensivity.
  - Single, reusable process for HIPAA and FISMA.
- Recently worked with Institute for Advanced Composites Manufacturing Innovation (IACMI) assess cybersecurity risks for their national “Composites Virtual Factory HUB” (cvfHUB).
  - NIST risk management standards, NIST 800-171 controls.
  - Comprehensive coverage, not a checkbox exercise.

UNIVERSITY INFORMATION TECHNOLOGY SERVICES
INDIANA UNIVERSITY

NIST National Institute of Standards and Technology U.S. Department of Commerce

HIPAA Health Insurance Portability & Accountability Act

NCGAS: Providing National Cyberinfrastructure to Biologists **doing** Genomics.

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NCGAS's primary goals:

Provide bioinformatics expertise

Maintain a curated set of genomic applications

Provide access to HPC resources, esp. large-memory clusters

Build Galaxy instances for our software

Pursue outreach to biologists

[Maintain an NCGAS team schooled in both biology and CI]

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Just a few of our users' projects

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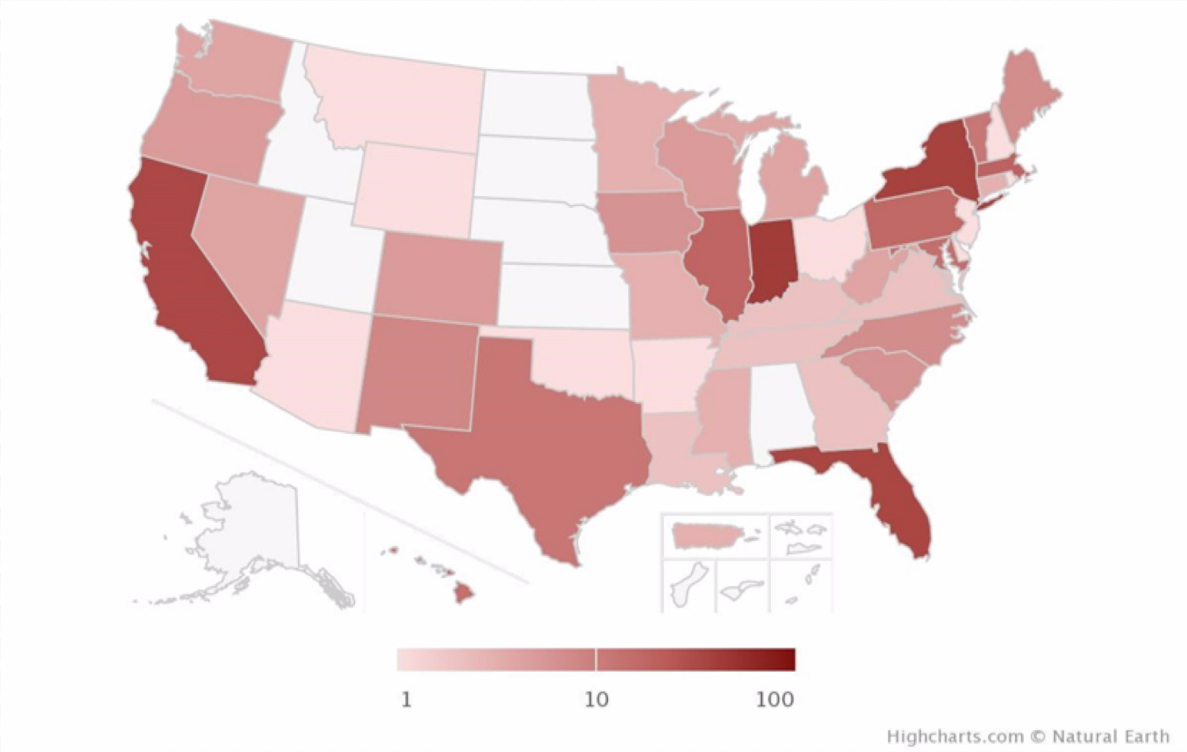
NCGAS users by State, 2018



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Research in Digital Science Center

Geoffrey Fox, January 19, 2018
Digital Science Center
Department of Intelligent Systems Engineering
gcf@indiana.edu, http://www.dsc.soic.indiana.edu/, http://spidal.org/

- Judy Qiu, David Crandall, Gregor von Laszewski, Dennis Gannon
- Supun Kamburugamuve, Pulasthi Wickramasinghe, Hyungro Lee, Jerome Mitchell
- Bo Peng, Langshi Chen, Kannan Govindarajan, Fugang Wang
- Internal collaboration. Biology, Physics, SICE
- Outside Collaborators in funded projects: Arizona, Kansas, Purdue, Rutgers, San Diego Supercomputer Center, SUNY Stony Brook, Virginia Tech, UIUC and Utah
- NIST and Fudan University

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Digital Science Center Research Activities

Building SPIDAL Scalable HPC machine Learning Library
Applying current SPIDAL in Biology, Network Science (OSoMe), Pathology
Harp HPC Machine Learning Framework (Qiu)
Twister2 HPC Event Driven Distributed Programming model (replace Spark)
Cloud Research and DevOps for Software Defined Systems (von Laszewski)
Intel Parallel Computing Center @IU (Qiu, Gottlieb)
Fudan-Indiana Universities' Institute for Transformational High-Performance Big-Data Computing
Work with NIST on Big Data Standards and non-proprietary Frameworks
Engineered nanoBIO Node NSF EEC-1720625 with Purdue and UIUC
Polar (Radar) Image Processing (Crandall); being used in production
Data analysis of experimental physics scattering results
IoTCloud. Cloud control of robots – licensed to C2RO (Montreal)

Big Data on HPC Cloud

Engineered nanoBIO Node

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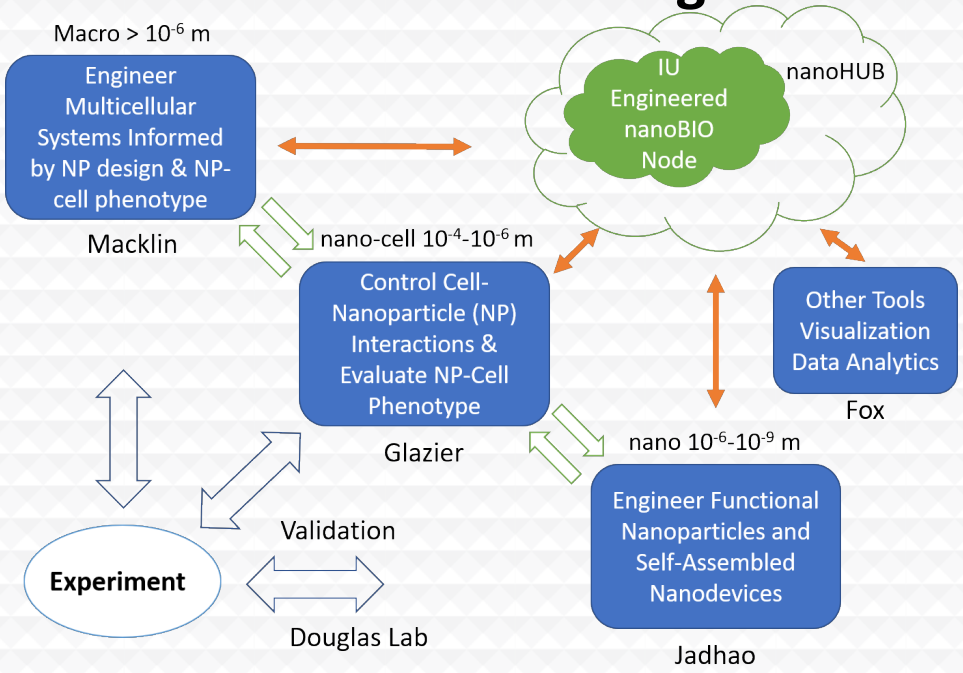
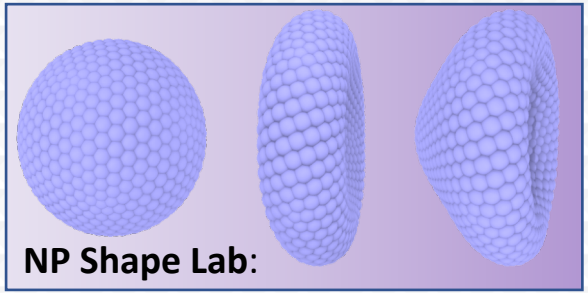
ENGINEERED nanoBIO
AN INDIANA UNIVERSITY RESEARCH NODE

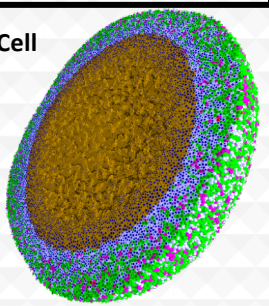
Multi-Scale Integrated



- Use in Undergraduate and masters programs in ISE for Nanoengineering and Bioengineering
  - ISE (Intelligent Systems Engineering) as a new department developing courses from scratch (67 defined in first 2 years)
- Research Experiences for Undergraduates throughout year
- Annual engineered nanoBIO workshop
- Summer Camps for Middle and High School Students
- Online (nanoHUB and YouTube) courses with accessible content on nano and bioengineering
- Research and Education tools build on existing simulations, analytics and frameworks: Physicell and CompuCell3D



PhysiCell

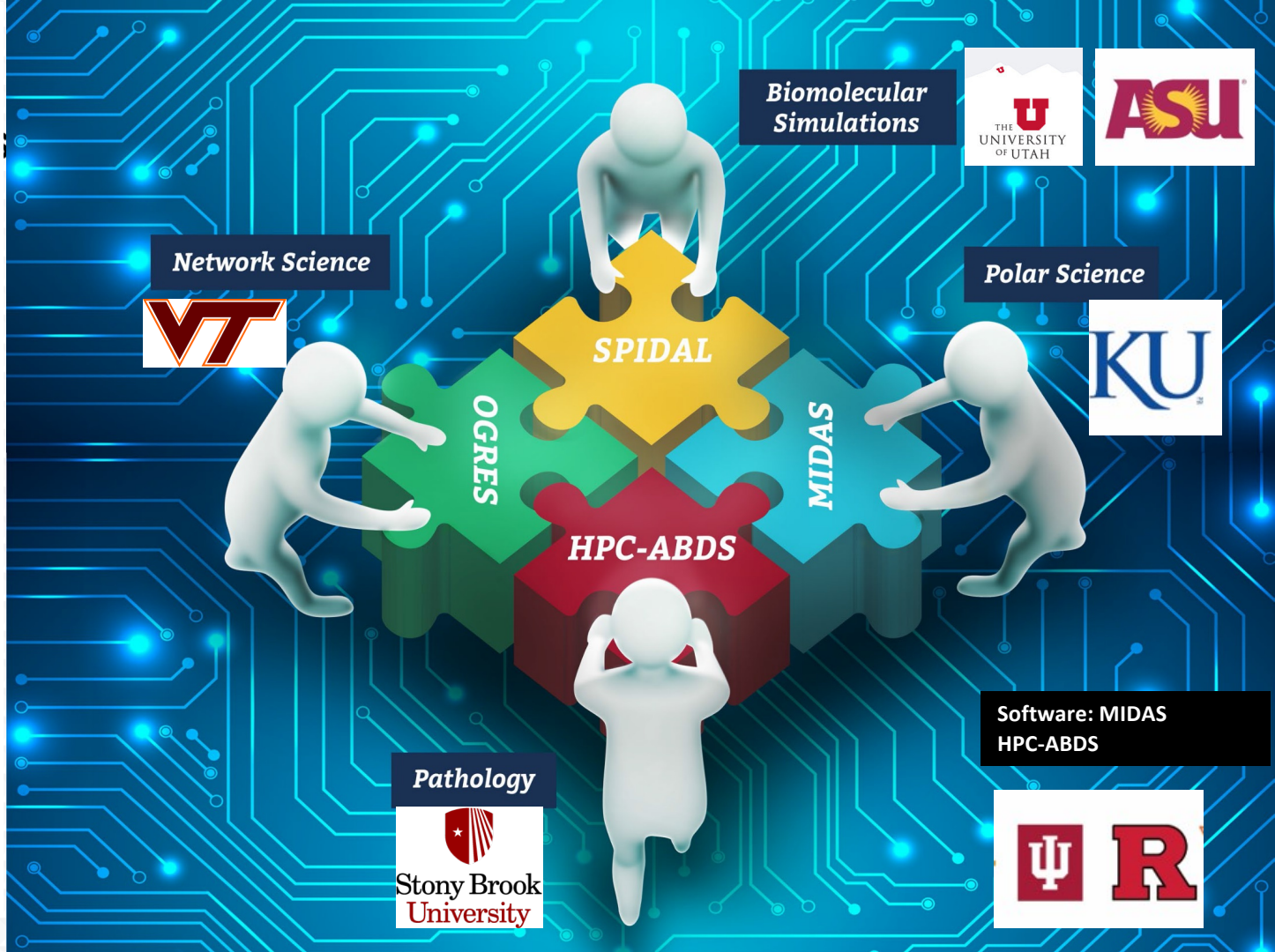


NSF 1443054: CIF21 DIBBs: Middleware and High Performance Analytics Libraries for Scalable Data Science

Ogres Application Analysis

HPC-ABDS and HPC-FaaS Software Harp and Twister2 Building Blocks

SPIDAL Data Analytics Library



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NEW!!!!!!!!!
Cloud research support engineers
Postdocs- WE WANT YOU!!!

- Demonstrate value of “humanware” - explore, advance, and develop evidence of the impact of the use of human resources—also known as "humanware"—to support and increase the use of cloud-based cyberinfrastructure (CI) by researchers in university environments in North America.
- ROI
- Honoraria to postdoctoral fellows - imited number of qualified individuals to fulfill the role of cloud research support engineer (CRSE). A total of up to six awards will be made.
- Funded by Microsoft
- If you are interested, send email to pti@iu.edu

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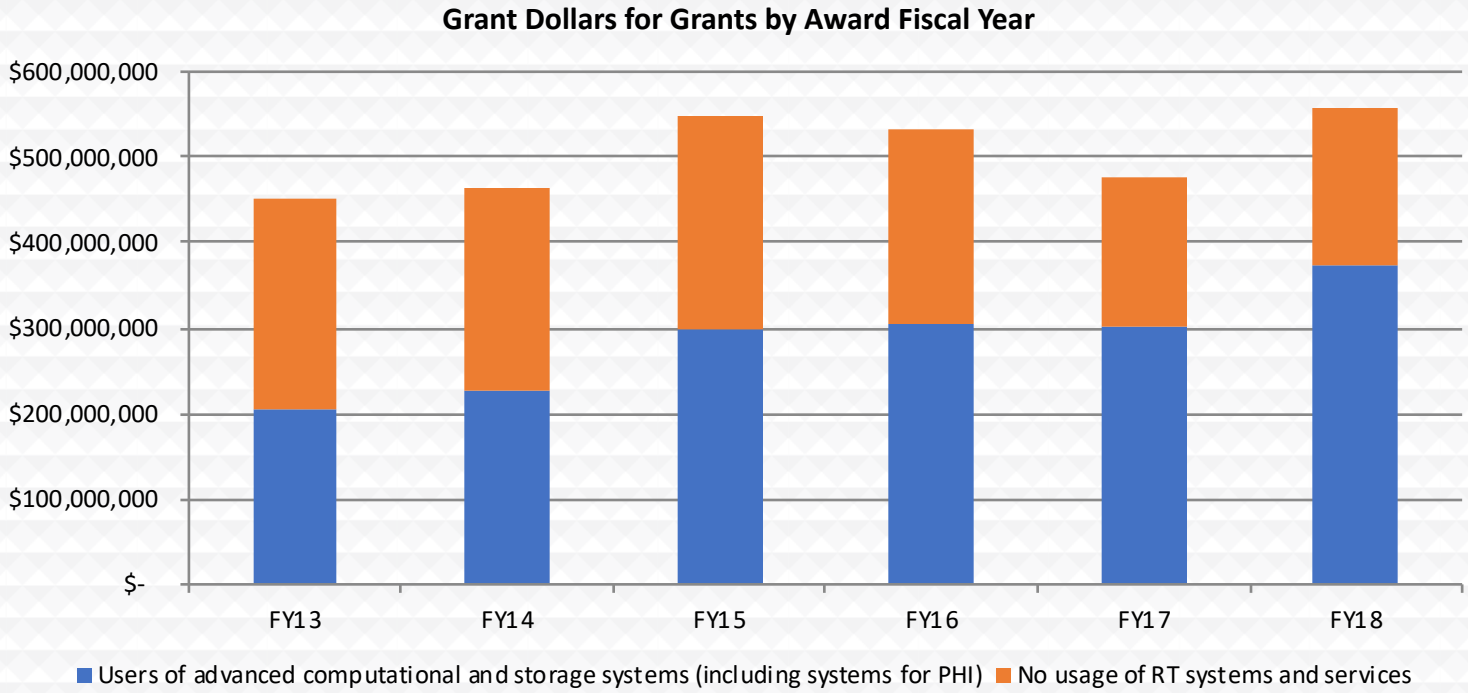
ROI



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A year of great success

- Jetstream
- Hathi Trust Phase II
- CACR CICI funding
- NCGAS refunding
- New funding from Microsoft for Cloud Research Support Engineers
- ROI research
- New HPC / cloud software
- > $10M new funding in aggregate

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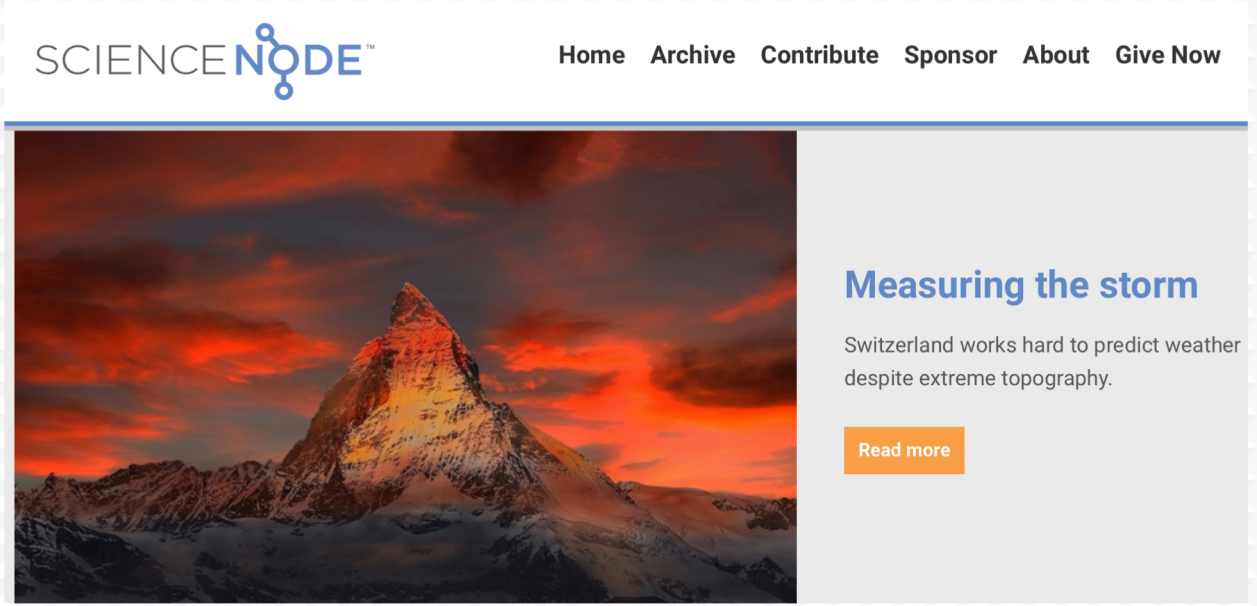
Utterly Shameless Plugs

- Follow PTI on Twitter at @iu_pti
- Follow @scinode on Twitter



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Jetstream is supported by NSF award 1445604 (David Y. Hancock, IU, PI; Craig Stewart, founding PI)

Science gateway development is supported by a number of grant awards from the NSF, most particularly Award 1339774 (Marlon Pierce, PI)

NCGAS is supported by the NSF award 1759906 and was previously supported by

The Hathi Trust Research Center is supported by a grant award from the HathiTrust and by co-investment from Indiana University and the University of Illinois Urbana-Champaign

CACR is supported by a number of grants; the projects mentioned here are supported by

- Award 1547272 (CICI: Center of Excellence: Center for Trustworthy Scientific Cyberinfrastructure)
- Award 1840034 (Award Research Security Operations Center (ResearchSOC)

Opinions presented here are those of the author(s) and do not necessarily represent the views of the NSF, IUPTI, IU, or the Lilly Endowment, Inc.

THANK YOU!